SECTION 1

EXECUTIVE SUMMARY

1.1 Authorization

The Energy Engineering Analysis Program (EEAP) for the Laundry Facilities at Walter Reed Army Medical Center (WRAMC) at Forest Glen, Maryland was authorized by the Department of the Army, Norfolk District Corps of Engineers, under Contract No. DACA65-88-C-0119 dated September 22, 1988.

1.2 Objectives of the Energy Study

The objectives of this contract, as explained in Paragraph 2, Deposition Form 2496 and Detailed Scope of Work (Appendix A) of the contract are as follows:

a. Perform a complete energy audit and analysis of the Laundry Facilities.

b. Review, use and incorporate applicable data and results of related energy conservation studies, past and current.

c. Perform a site survey to insure that all methods of energy conservation which are practical have been considered.

d. Identify all Energy Conservation Opportunities (ECOs), including low cost/no cost ECOs, and perform a complete evaluation of each.

e. Prepare programming documentation for all Energy Conservation Investment Program (ECIP) projects (DD Form 1390, Life Cycle Cost Analysis Summary Sheet with backup calculation and Project Development Brochure (PDB)).

f. Prepare implementation documentation for all justifiable ECOs.

g. List and prioritize all recommended ECOs.

h. Prepare a comprehensive report which will document the work accomplished, the results and the recommendations.

1.3 Phases of Work

The work to be performed under the Contract has been divided into three phases:

Phase I Field investigation and data gathering.

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

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Phase II Data Analysis: Analysis of data, identification of potential projects, performance of feasibility and economic studies and preparation of Life Cycle Cost Analysis forms. During this phase, all potential projects which produce energy and/or dollar savings will be identified and evaluated as to their technical and economical feasibility. Projects will be ranked according to the highest saving investment ratio (SIR) value.

Phase III Report Preparation: Project documentation for Energy Conservation Investment Program (ECIP) and non-ECIP Projects, and non feasible Energy Conservation Opportunities (ECOs). Preparation of DD Form 1391 and Project Development Brochures (PDB) for ECIP Projects.

1.4 Submission Requirements

As outlined in the contract, the study is divided into three major submissions.

a. Interim Submittal

b. Pre-Final Submittal

c. Final Report

1.5 Work Accomplished

Entrance meeting was held with the Chief of Operation Division of WRAMC, Directorate of Engineering and housing, on October 31, 1988 to discuss scope of work, plans and schedule, and to be familiar with the facilities.

Field surveys of the Laundry Facilities were carried out from November 4, 1988 through December 20, 1988. During that time, a team from Gipe Associates, Inc. (GAI) carried out tests, observations and interviews with operating and maintenance facilities personnel. Air flow and temperature measurements for air handling units, heating and ventilating units, and exhaust air fans was conducted by Weisman Inc., a testing and balancing company. The measurements of air flow rates were interrupted from December 20, 1988 through February 21, 1989 because of dirty coils and filters in the air handling, and heating and ventilating units. These measurements were completed on February 28, 1989.

The exit meeting was held on March 6, 1989 at the Deputy Director of Engineering and Housings office in Building 1, Walter Reed Army Medical Center.

Presently, the Laundry Facilities is not equipped with a separate electric meter to provide the yearly electrical power consumptions for the present and previous years. However, estimated electrical

power consumptions were provided by the Chief of Operation Division for WRAMC as indicated in Appendix D. In comparing these estimated values with the simulated energy consumption computer program for the facilities, discrepancies were found in the result. Therefore, it was decided that the electrical supply to the facilities should be metered for a week to determine the electrical power consumption during this period. Because the major facilities electrical load is the Laundry equipment and processes which are approximately constant throughout the year, the metered electrical consumption values was used for the basis of this study. Maryland Electrical Testing Company (MET) was acquired by GAI to measure the electrical power consumption for the facilities. MET installed an electrical meter on the main power supply to the facilities from February 3 through 10, 1989.

Facilities occupancy pattern was established and analyzed. Energy use and patterns were obtained from the Operation Division for WRAMC. Facilities equipment was examined and its performance investigated. Lighting, HVAC, laundry equipment and other energy uses were carefully checked for energy conservation opportunities.

Computer program was utilized to determine peak cooling and heating loads, and annual energy conseumption and cost for the facility. Energy savings and saving investment ratios were calculated for various energy conservation opportunities.

The report is made up of four volumes. The first volume contains the narrative part of the report. The second volume contains the Executive Summary only. The third volume includes the appendices for scope of work, minutes of meetings, Building "U" factors and area calculations, utility rate summary, energy conservation opportunities calculations, weather data, selected Carrier computer program printout, measurement data, boiler water treatment analysis reports and electrical testing report. The fourth volume contains the appendix for equipment data.

1.6 The Laundry Facility Description

The Laundry Facility is a self-contained facility with 32,125 gross square feet of floor space. It was designed in April 1973 and completed in September 1975. It is located at Walter Reed Army Medical Center at Forest Glen, Maryland as shown in Figure I-1. The Laundry Facility is consisted of the Laundry Receiving Area, Laundry Production Area, Boiler Room and Office Area as shown in Figure I-2.

The Laundry Facility is utilized Monday through Friday as follows:

Areas	Hours of Use	Normal Occupancy
Offices	0600-0700	1

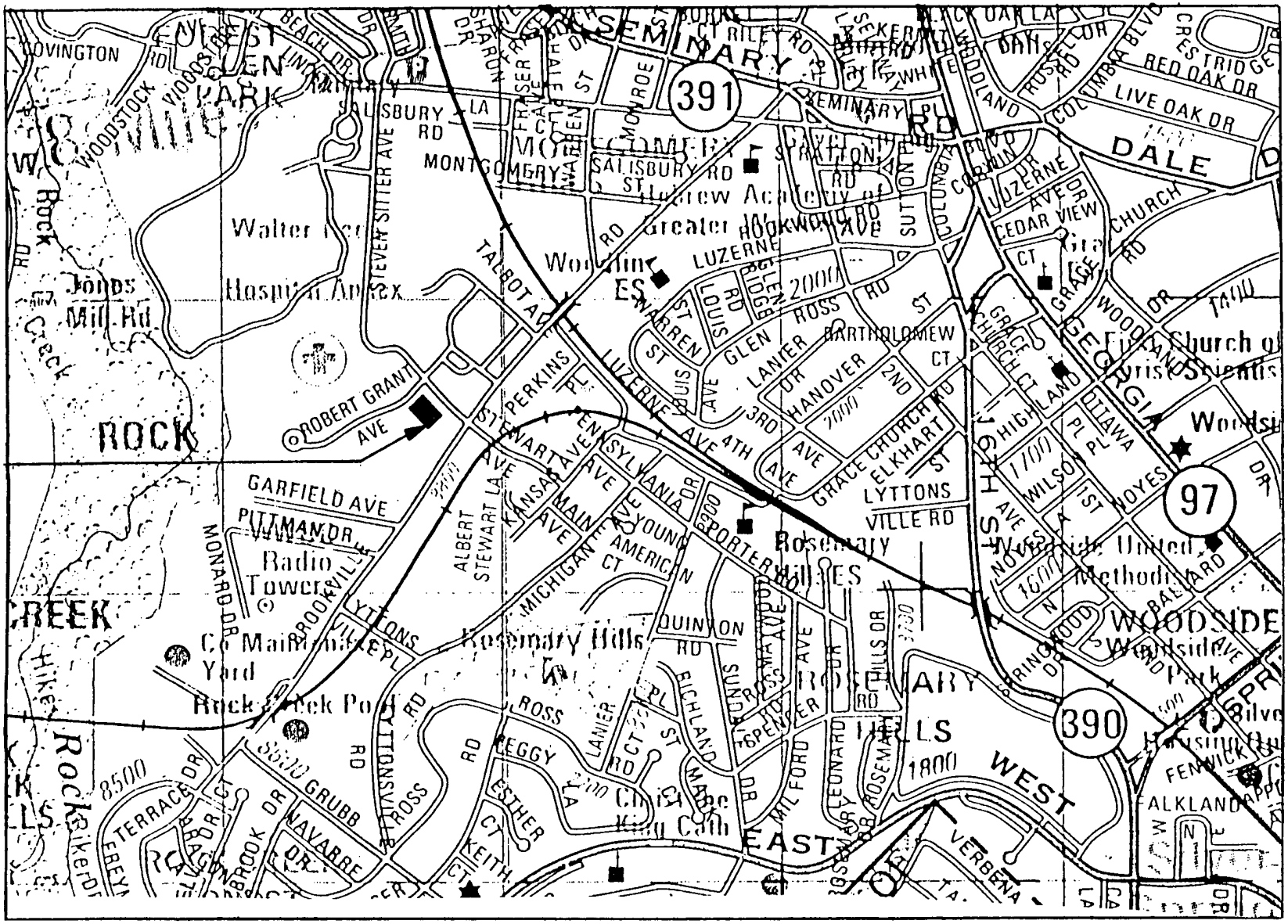

FIGURE I-1 -WALTER REED LAUNDRY FACILITY VICINITY MAP

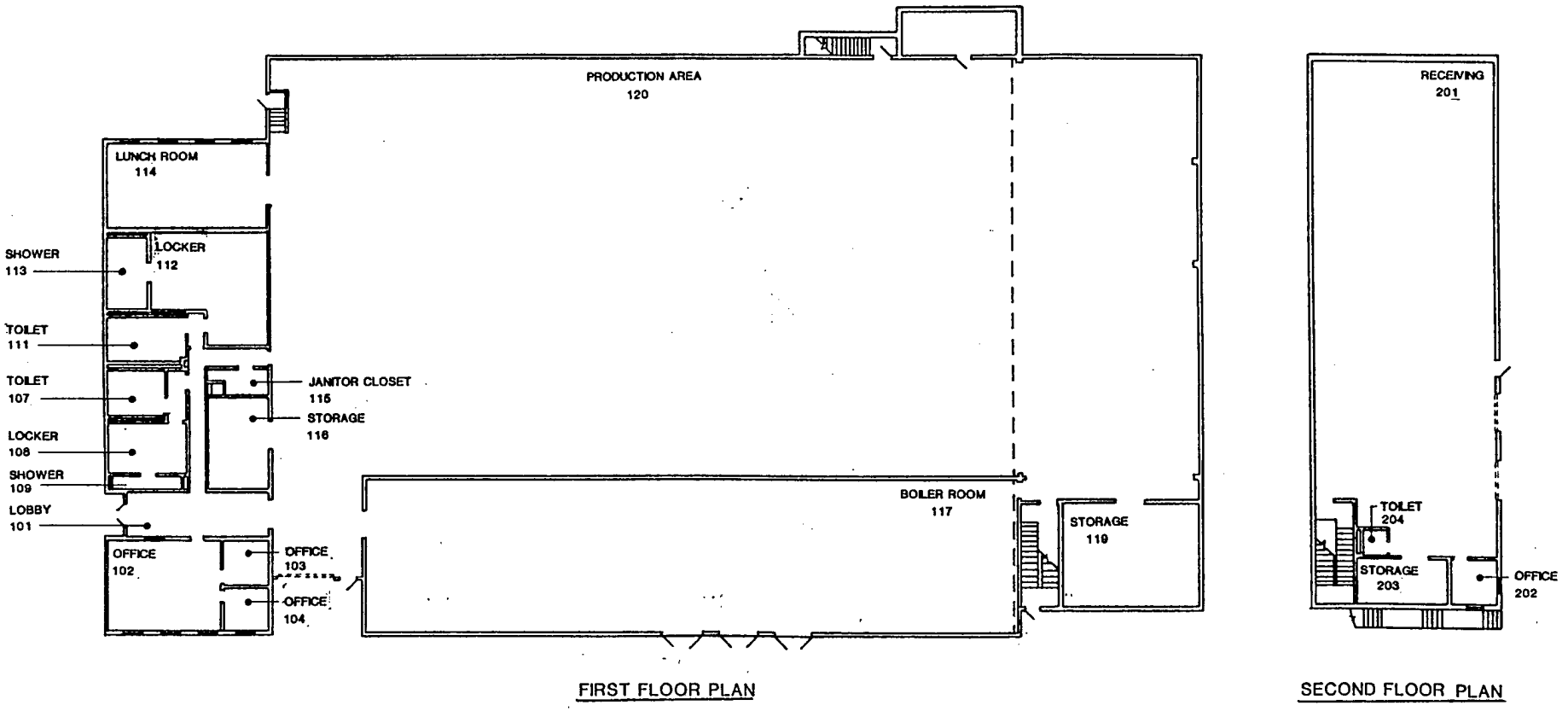

FIGURE 1-2 WALTER REED LAUNDRY FACILITY

Gipe Associates
CONSULTANTS
BALTIMORE ——— EASTON
MARYLAND

Offices	0700-1530	3
Production & Receiving	0600-0700	4
	0700-1430	33
	1430-1530	29
	1530-2300	1

The building is a one story/partial second story, concrete masonry walls and flat roof type. Single-glazed, inoperable windows are provided in the offices and Lunch Room. All windows have venetian blinds except those in the Receiving Area Office and the Lunch Room. Lunch Room windows have draperies. All windows and doors are weatherproofed. The main entrance to the offices is provided with two - 7'x3' swinging glass doors. The Production Area is provided with a 12'x12' roll type loading dock door, while the Receiving Area is provided with two 8'x8' roll type loading dock doors. The loading dock doors are provided with plastic strip curtains to prevent outdoor air infiltration to the building. However, the bolts for support brackets of the loading dock plastic strip curtains in the Receiving Area are missing, and therefore, they have resulted in ineffective use of these curtains. The roof is a builtup type with rigid insulation.

The Facility is provided with three 350 horsepower steam boilers. These boilers provide steam at approximately 125 psig for space and domestic hot water heating, and laundry processes. Fuel Oil No. 2 is used.

A 750 KVA transformer drops the voltage from 13200 volts, 3 phase to 480/277 volts, 3 phase, 4 wire grounded wye. Distribution panel boards are located in the building. 400 watt Mercury Vapor and 500 watt incandescent emergency lighting fixtures are provided in the Production and Receiving Areas. While 4'x2' fluorescent type fixtures with 4 lamps are provided in offices, and 4'x1' fluorescent type fixtures with 2 lamps are provided in Boiler Room, Locker Rooms and Toilets.

The largest concentrated building loads are the laundry equipment, Boiler Room equipment, and heating, ventilating and air conditioning equipment.

1.7 Facility Systems:

Facility is served by the following systems:

Domestic and Process Cold Water System
Domestic and Process Hot Water System
Boiler Plant
Air Conditioning System
Heating and Ventilating System
Exhaust Air System
Cabinet and Unit Heating System
Automatic Temperature Control System

Electrical System
Lighting System
Laundry System

1.8 Facility Peak Cooling and Heating Loads

The peak cooling and heating loads for the Laundry Facility is approximately 8.7 tons and 1,776,880 Btuh, respectively. These loads are distributed as follows:

Area	Cooling Load in Tons	Heating Load in Btuh
Offices	8.7	89,000
Toilet & Locker Rooms	---	119,230
Production & Receiving	20.0 (1)	1,568,650
Total	28.7	1,776,880

1.9 Present Energy and Utility Consumption

The present energy consumption of the Laundry Facility was analyzed using Carrier E20-II Hourly Analysis Computer Program. Annual energy consumption breakdown for the facility is shown in Table I-1 and Figure I-3. The annual total energy consumption is approximately 32,980 x 10^6 Btu. The largest energy use is for the laundry processes hot water and steam (67.4%), followed by heating (21.5%).

Table I-2 and Figure I-4 show the present utility annual consumption. The largest utility consumption is fuel oil No. 2 (88.9%), followed by electricity (11.1%). The actual annual FY 1988 data is 205,153 gallons fuel oil (211,355 gallons calculated) and estimated 259,140 Kwhr (1,072,380 Kwhr calculated) electricity. However, the measured annual electrical power consumption is 1,337,860(2) Kwhr. Monthly total utility onsumption is shown in Figure I-5.

1.10 Present Energy and Utility Cost

The present annual energy cost of the Laundry Facility as computed by Carrier Program is shown in Table I-3 and Figure I-6. The total annual energy cost is approximately $212,100 ($138,070 for oil and $74,030 for electricity).

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1) Spot Cooling

2) Measured electrical power consumption for one week and multiplied by 52 weeks.

TABLE I-1 - ANNUAL SYSTEM ENERGY CONSUMPTION

Building : WALTER REED LAUNDRY FAC.
Site : Walter Reed, Washington
Prepared By : GIPE ASSOCIATES INC
Carrier Hourly Analysis Program

05-05-89
6121587110

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TABLE 1. ENERGY BY COMPONENT

Component	(---- Annual Energy * ---> (KBTU)	(KBTU/sqft)	% of Total
Air System Fans	347,238	10.950	1.1 %
Cooling Plants	27,166	0.857	0.1 %
Heating Plants	7,104,522	224.047	21.5 %
Pumps	20,804	0.656	0.1 %
>>> HVAC Subtotal	7,499,730	236.510	22.7 %
Lights	977,329	30.821	3.0 %
Other Electric	1,858,880	58.621	5.6 %
Miscellaneous Electric	422,325	13.318	1.3 %
Domestic Hot Water	22,217,837	700.657	67.4 %
>>> Non-HVAC Sub-total	25,476,370	803.418	77.3 %
>>> GRAND TOTAL	32,976,100	1039.927	100.0 %

* Note: 1. KBTU per unit floor area is based on the gross building floor area. For this building:

Gross floor area	=	31,710 sqft
Conditioned floor area	=	26,900 sqft

2. Other Electric - Laundry equipment motors

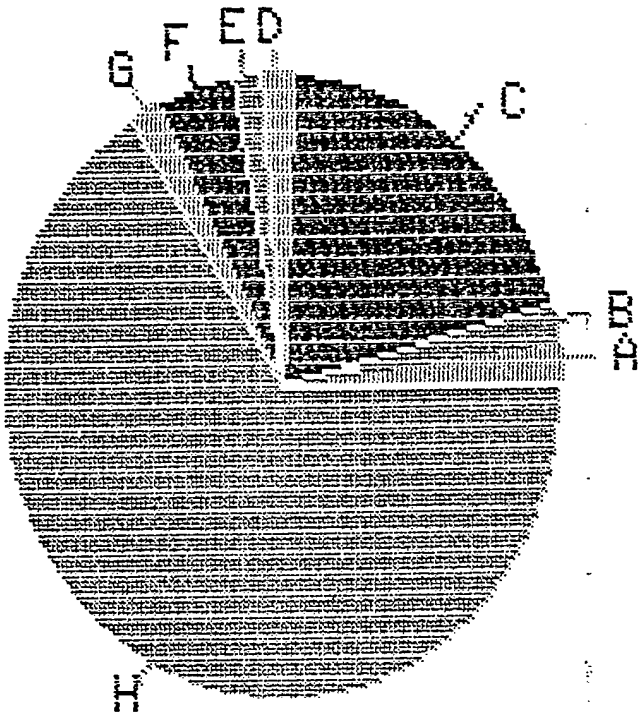
3. Miscellaneous Electric - Boiler room motors

4. Domestic Hot Water - Domestic and process hot water, and process steam

FIGURE I-3 - ANNUAL SYSTEM ENERGY CONSUMPTION

WALTER REED LAUNDRY FAC.
Walter Reed, Washington

05-05-89
HAP 1.10



KEY		
A	Fans	1.1%
B	Cooling	.1%
C	Heating	21.6%
D	Pumps	.1%
E	Lights	3.0%
F	Other El	5.6%
G	Misc El	1.3%
H	DHW	67.4%

Total KBTU = 32976099 KBTU

Notes:

1. Other Electric -Laundry equipment motors
2. Miscellaneous Electric - Boiler room motors
3. Domestic Hot Water - Domestic and process hot water, and process steam

TABLE I-2 - ANNUAL UTILITY CONSUMPTION

Building : WALTER REED LAUNDRY FAC.
Site : Walter Reed, Washington
Prepared By : GIPE ASSOCIATES INC
Carrier Hourly Analysis Program

05-05-89
6121587110

****

TABLE 1 ENERGY BY ENERGY CATEGORY

HVAC Component	Annual Energy	(---- Annual Energy (KBTU)	* --) (KBTU/sqft)	% of Total
Electric	117949 kWh	402,561	12.695	1.2 %
Natural Gas	0 .Therms	0	0.000	0.0 %
Fuel Oil	70972 Therms	7,097,168	223.815	21.5 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
Remote Cooling	0 Therms	0	0.000	0.0 %
))) HVAC Subtotal		7,499,730	236.510	22.7 %
Non-HVAC Component				
Electric	954742 kWh	3,258,533	102.760	9.9 %
Natural Gas	0 Therms	0	0.000	0.0 %
Fuel Oil	222178 Therms	22,217,837	700.657	67.4 %
Propane	0 Therms	0	0.000	0.0 %
Remote Heating	0 Therms	0	0.000	0.0 %
))) Non-HVAC Subtotal		25,476,370	803.418	77.3 %
))) GRAND TOTAL		32,976,100	1039.927	100.0 %

* Note: 1. KBTU per unit floor area is based on the gross building floor area. For this building:

Gross floor area = 31,710 sqft
Conditioned floor area = 26,900 sqft

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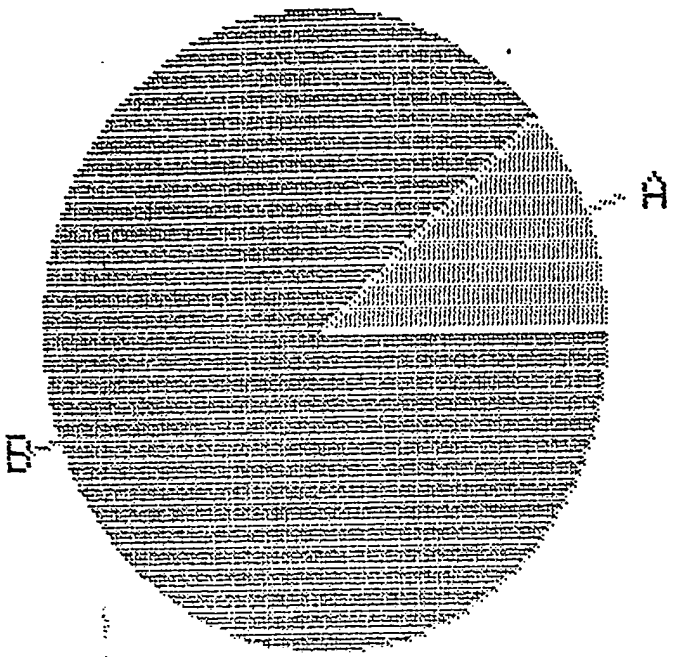
FIGURE I-4 – ANNUAL UTILITY CONSUMPTION

WALTER REED LAUNDRY FAC.
Walter Reed, Washington

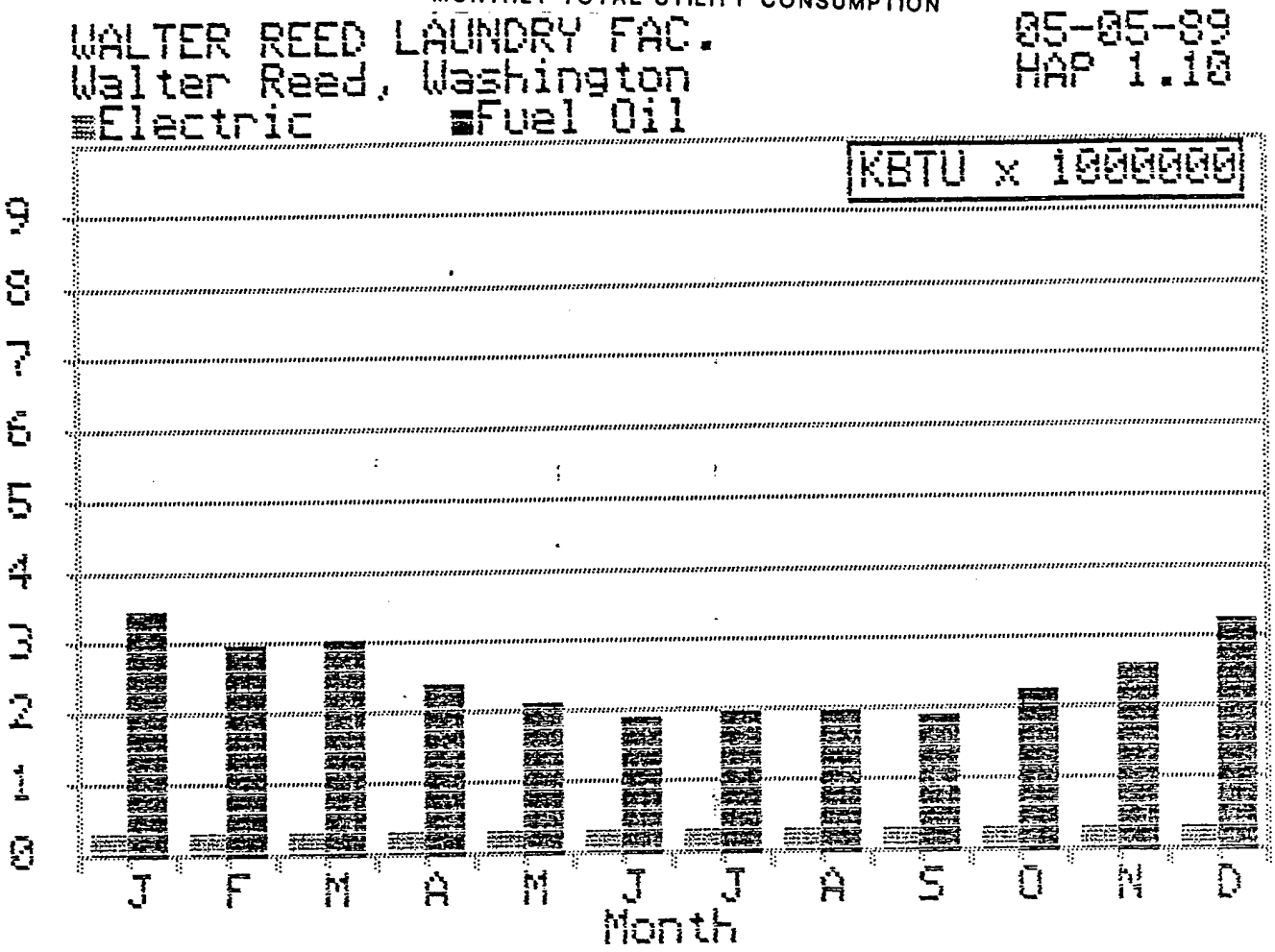
05-05-89
HAP 1.10

KEY		
A	Electric	11.1%
B	Fuel Oil	88.9%



Total KBTU = 32976101 KBTU

FIGURE I-5 - MONTHLY TOTAL UTILITY CONSUMPTION



Energy

TABLE I-3 ANNUAL SYSTEM ENERGY COST

Building : WALTER REED LAUNDRY FAC. 05-05-89
Site : Walter Reed, Washington 6121587110
Prepared By : GIPE ASSOCIATES INC
Carrier Hourly Analysis Program

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TABLE 1. COSTS BY COMPONENT

Component	(---- Annual Costs * ---> ($)	($/sqft)	% of Total
Air System Fans	7,020	0.221	3.3 %
Cooling Plants	549	0.017	0.3 %
Heating Plants	33,577	1.059	15.8 %
Pumps	421	0.013	0.2 %
>>> HVAC Subtotal	41,567	1.311	19.6 %
Lights	19,758	0.623	9.3 %
Other Electric	37,581	1.185	17.7 %
Miscellaneous Electric	8,538	0.269	4.0 %
Domestic Hot Water	104,649	3.300	49.3 %
>>> Non-HVAC Sub-total	170,526	5.378	80.4 %
>>> GRAND TOTAL	212,094	6.689	100.0 %

* Note: 1. Cost per unit floor area is based on the gross building floor area. For this building:

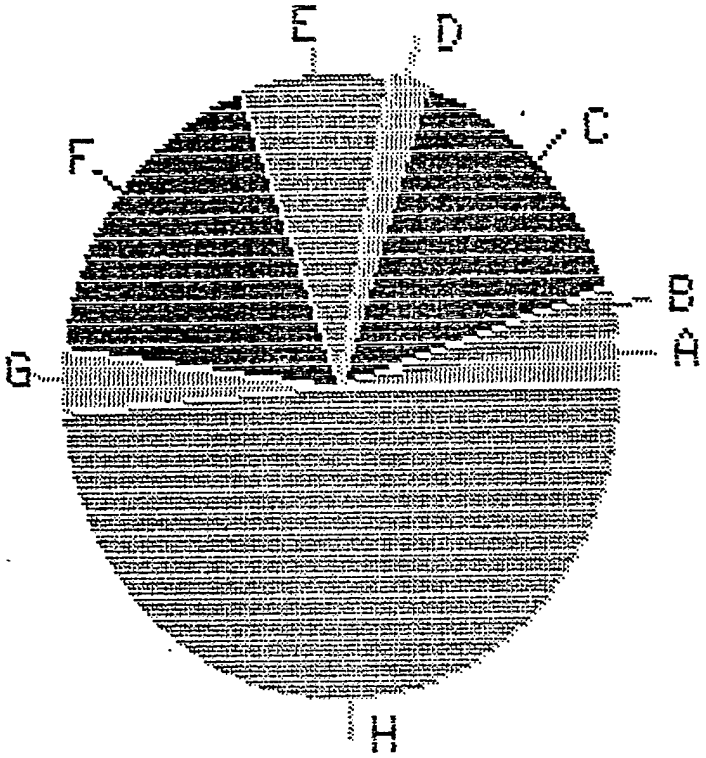
Gross floor area	=	31,710 sqft
Conditioned floor area	=	26,900 sqft

2. Other Electric -Laundry equipment motors
3. Miscellaneous Electric - Boiler room motors
4. Domestic Hot Water - Domestic and process hot water, and process steam

FIGURE I-6 - ANNUAL SYSTEM ENERGY COST

WALTER REED LAUNDRY FAC.
Walter Reed, Washington

05-05-89
HAP 1.10



KEY		
A	Fans	3.3%
B	Cooling	.3%
C	Heating	15.8%
D	Pumps	.2%
E	Lights	9.3%
F	Other El	17.7%
G	Misc El	4.0%
H	DHW	49.3%

Total Cost = 212094 $

Notes :

1. Other Electric - Laundry equipment motors
2. Miscellaneous Electric - Boiler room motors
3. Domestic Hot Water - Domestic and process hot water , and process steam

Present Annual Utility Cost for the Laundry Facility is shown in Table I-4 and Figure I-7. The total annual fuel oil cost is $138,070 (65.1% of total utility cost) and that for electricity is $74,030 (34.9%). Monthly total utility cost is shown in Figure I-8.

1.11 Facility Energy History

The actual annual electrical power consumption for the Laundry Facility is unavailable. The annual fuel oil consumptions for the Laundry Facility for FY 1986, 1987 and 1988 are shown in Appendix D.

The annual energy consumption in MBtu and MBtu per square foot area for the facility are shown in Figures I-9 and I-10 respectively, and the yearly energy cost is shown in Figure I-11.

1.12 Energy Conservation Opportunities (ECOs) Investigated

A total of 48 ECOs were studied and are listed as follows:

ECO No.	Architectural ECOs
1.	Insulation (a. Wall; b. & c. Roof; d. Pipe; e. Duct)
2.	Insulated Glass or Double Glazed Windows
3.	Weather Stripping and Caulking
4.	Insulated Panels
5.	Solar Films
6.	Vestibules
7.	Reduction Glass Areas
8.	Use Air Curtains/Plastic Strips at Personnel Entrances
9.	Provide Loading Dock Enclosure
	Plumbing ECOs
10.	Booster Heaters at Major Hot Water Users
11.	Lower Domestic Hot Water Temperature
12.	Use of Heat Pump for Domestic Hot Water Heating and Facility Cooling
13.	Shut Down DHW Circulating Pump
14.	Shut Down DHW and PHW Circulating Pumps
15.	Shut Down Energy to Hot Water Heaters or Modify Controls
16a.	Recover Heat from AHU-1 for DHW Preheat
16b.	Recover Heat from AHU-2 for PHW Preheat
	HVAC ECOs
17.	Make HVAC Operations More Efficient
18.	Thermal Storage
19.	Night Setback Thermostat
20.	Infrared Heaters

TABLE I-4 - ANNUAL TOTAL UTILITY COST

Building : WALTER REED LAUNDRY FAC. 05-05-89
Site : Walter Reed, Washington 6121567110
Prepared By : GIPE ASSOCIATES INC
Carrier Hourly Analysis Program

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TABLE 1. COSTS BY ENERGY CATEGORY

HVAC Component	Annual Energy	(---- Annual Costs * --) ($)	($/sqft)	% of Total
Electric	117949 kWh	8,139	0.257	3.8 %
Natural Gas	0 GALS.	0	0.000	0.0 %
Fuel Oil	51429 GALS.	33,429	1.054	15.8 %
Propane	0 GALS.	0	0.000	0.0 %
Remote Heating	0 GALS.	0	0.000	0.0 %
Remote Cooling	0 GALS.	0	0.000	0.0 %
››› HVAC Subtotal		41,567	1.311	19.6 %
Non-HVAC Component				
Electric	954742 kWh	65,877	2.077	31.1 %
Natural Gas	0 GALS.	0	0.000	0.0 %
Fuel Oil	160999 GALS.	104,649	3.300	49.3 %
Propane	0 GALS.	0	0.000	0.0 %
Remote Heating	0 GALS.	0	0.000	0.0 %
››› Non-HVAC Subtotal		170,526	5.378	80.4 %
››› GRAND TOTAL		212,094	6.689	100.0 %

* Note: 1. Cost per unit floor area is based on the gross building floor area. For this building:

Gross floor area = 31,710 sqft
Conditioned floor area = 26,900 sqft

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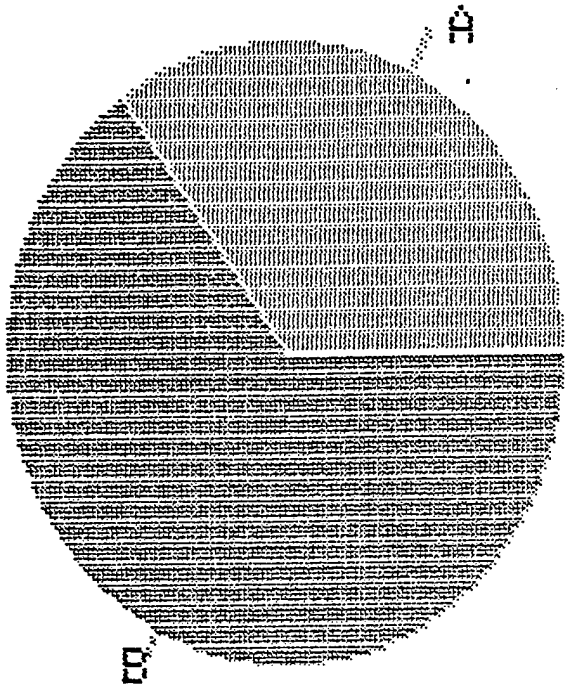
FIGURE I-7 - ANNUAL UTILITY COST

WALTER REED LAUNDRY FAC.
Walter Reed, Washington

05-05-89
HAP 1.10

KEY		
A	Electric	34.9%
B	Fuel Oil	65.1%



Total Cost = 212094 $

FIGURE I-8 - MONTHLY TOTAL ENERGY COST

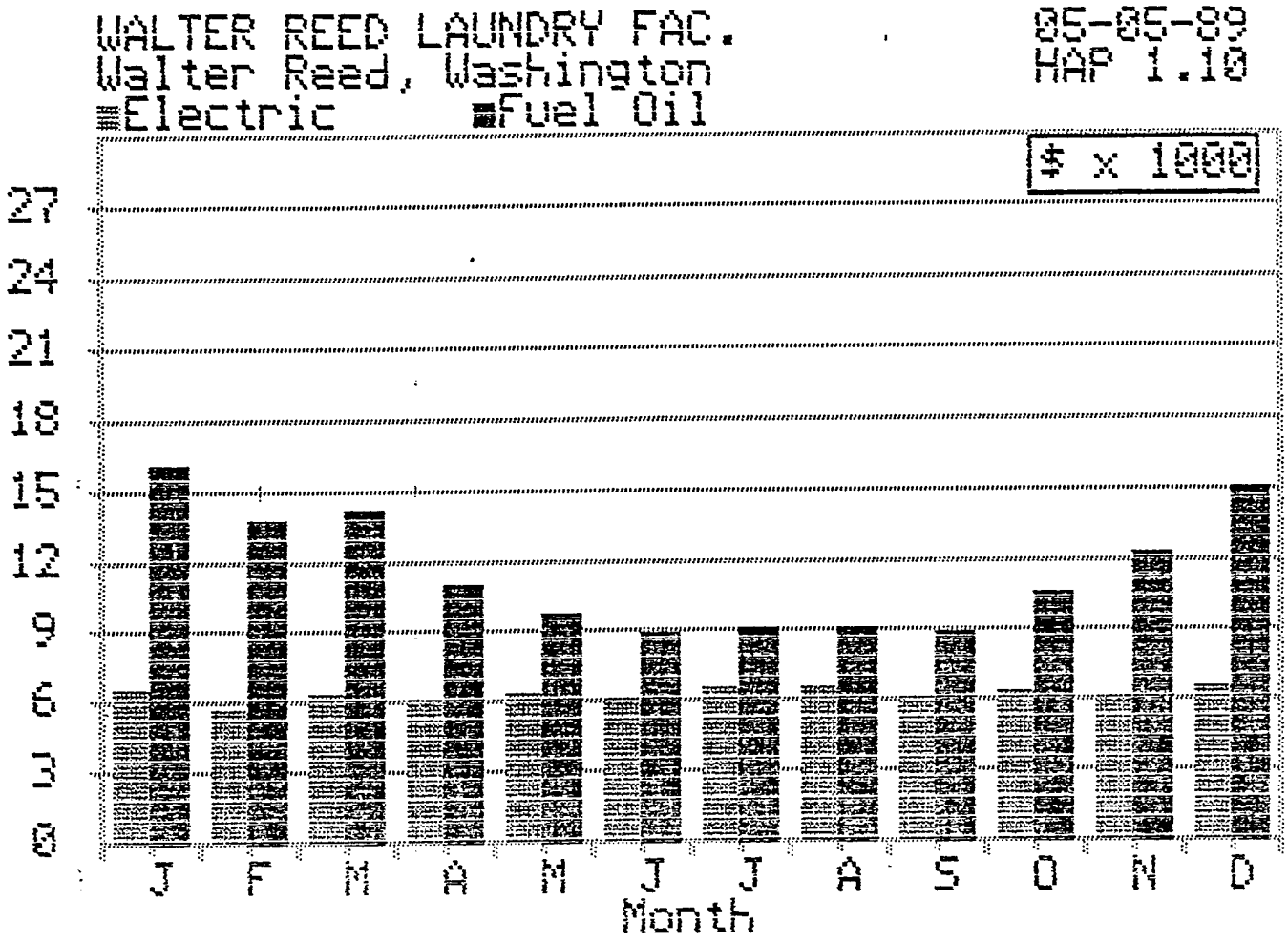


FIGURE 1-9-YEARLY ENERGY CONSUMPTION

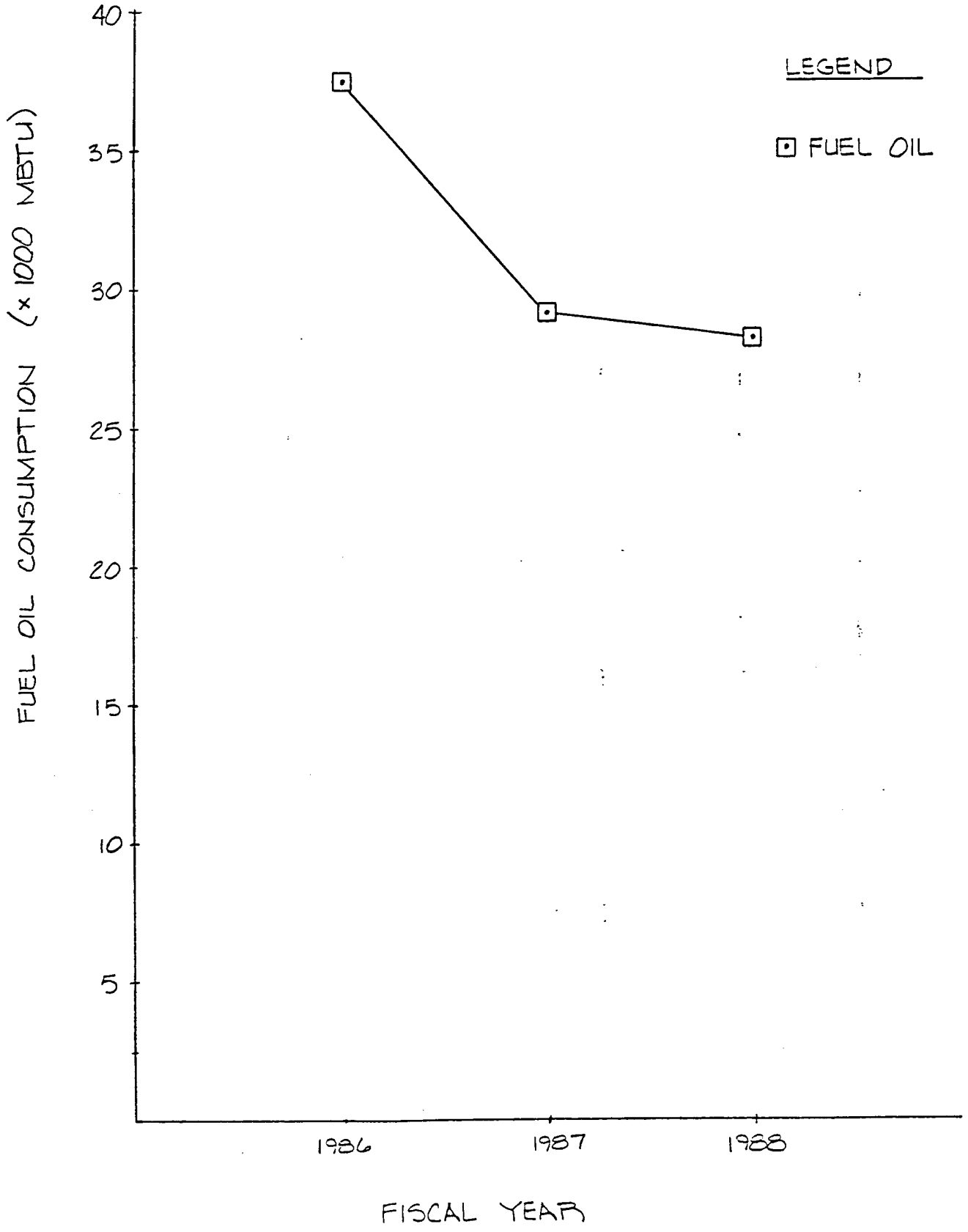


FIGURE I-10-YEARLY ENERGY CONSUMPTION PER SQUARE FOOT AREA

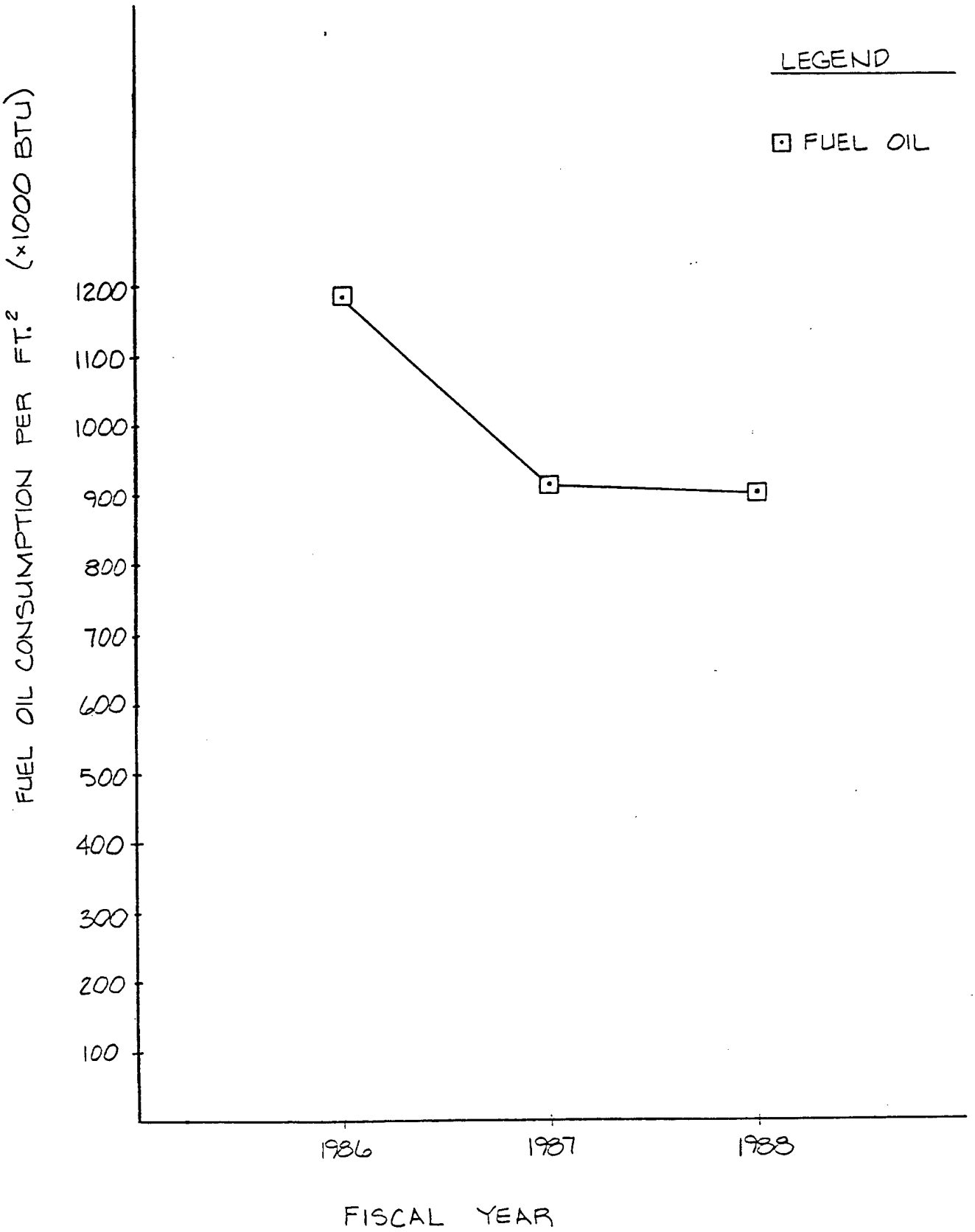
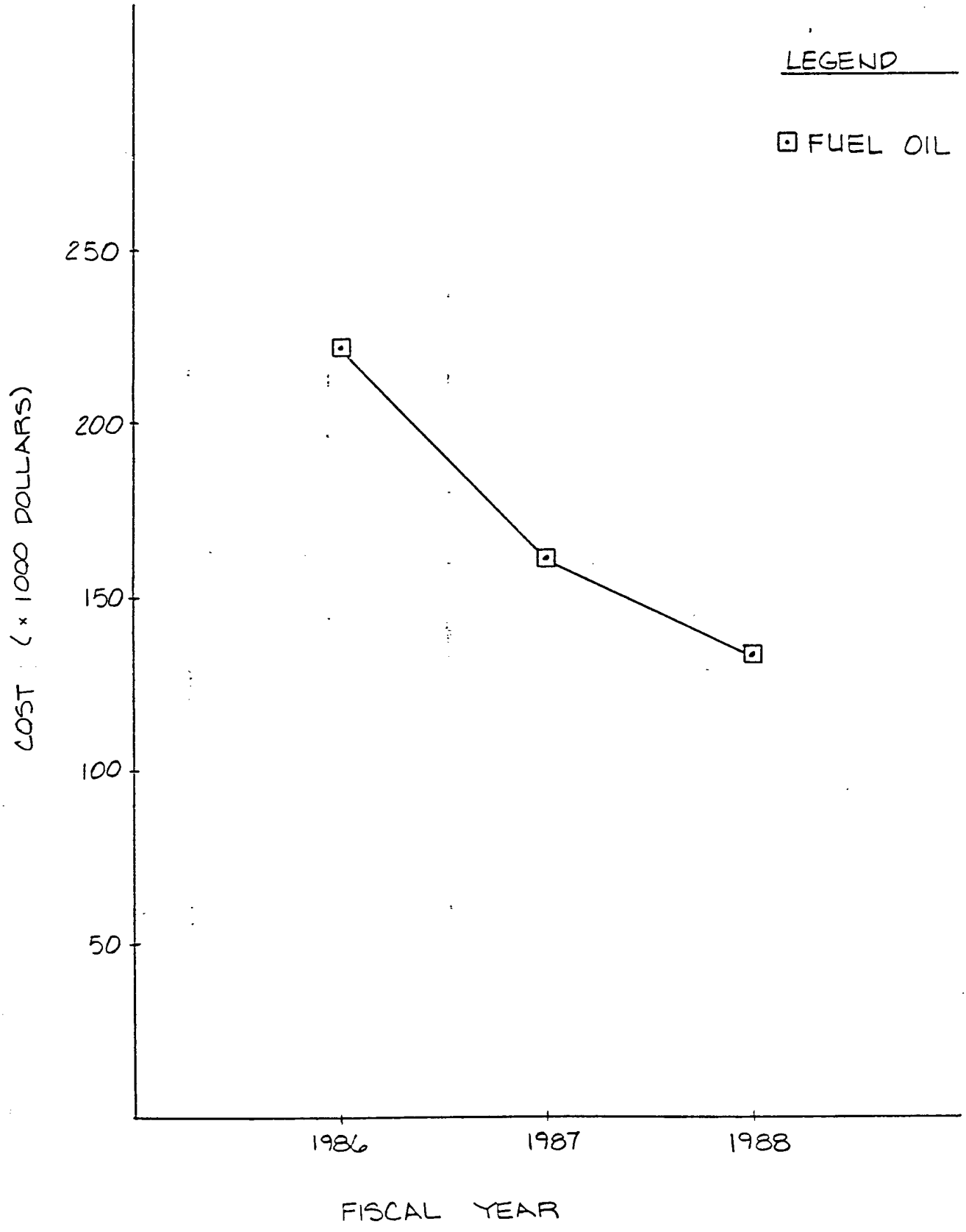


FIGURE I-11-YEARLY ENERGY COST



22. Upgrade HVAC Controls
23. Balance HVAC System
24. Change to Variable Air Volume (VAV) System
25. Heat Destratification

Steam System ECOs

26. Steam Traps (Size, Operation, Type)
27. Verify that Supply Steam and Condensate System is Functioning in the Most Efficient Manner
28. Shut Off Steam Supply During Non-Use Hours
29. Correct Sizes of Condensate Lines
30. Insulate Boiler and Boiler Piping
31. Check Boiler Water Chemistry Program
32. Clean Boiler Tubes
33. Recover Heat from Flue Gases

Electrical ECOs

34. Energy Conserving Fluorescent Lamps and Ballasts
35. Reduce Lighting Level
36. Replace Incandescent Lighting
37. Use More Efficient Lighting Source
38. Fluorescent Light Fixture Reflectors

Laundry Processes ECOs

39. Heat Reclaim from Laundry Equipment
40. Heat Recovery from Laundry Wash Water
41. Optimize Laundry Facilities Operations (Space Utilization, More Efficient Equipment-Operational Procedures)
41a. New Washers - Conventional Type
41b. New Dryers
41c. New Washers - Continuous Batch Type
42. Dryers Equipped with Temperature Sensor Located on Discharge Duct. Sensor to Provide Information to Stop Heating During Drying Cycle at Most Energy Point
43. Recycling of Rinse Water for a Following Wash Cycle
44. Equipping Dryer Exhaust with Exchanger for Preheating Incoming Air to Dryer
45. Utilization of High Temperatures, Oil Heated Processes Rather than Steam
46. Use of Cold Water for Laundring
47a. Waste Water Recovery - Reactivation of the Existing Reclaimer
47b. Waste Water Recovery - Replacement of the Existing Reclaimer with a New Unit
48. Efficiency of Compressed Air

These ECOs were a result of the facility survey and those listed in Annex A of the contract. The construction cost, annual energy savings, annual cost savings, the SIR and the simple amortization

period for the ECOs are shown in Table I-5. All analysis were performed in 1989, except utility costs are based on FY 1988. Table I-6 shows a prioritized summary of the studied energy conservation opportunities by the order of SIR.

1.13 Analysis of Energy Conservation Opportunities

The ECOs are classified in one of the following catagories as described in Paragraph 5 of the project scope of work (Appendix A, Volume 2):

	Construction Cost, $	SIR	SPB *
ECIP	> $200,000	> 1	< 8
Non-ECIP		> 1	
a. QRIP	≤ $100,000	> 1	≤ 2
b. OSD PIF	> $100,000	> 1	≤ 4 **
c. PEC IP	> $100,000	> 1	≤ 4
Regular Military Construction Army Program (MCA)	> $200,000	> 1	10 to 25 Years
Low Cost/No Cost Projects	Low Cost/No Cost	---	---

Based on the aforementioned catagories, Table I-7 shows the ECOs which are classified as ECIP, QRIP and No Cost/Low Cost projects. ECOs - 41a, 41b and 41c are classified as ECIP. ECOs - 47a and 23 are classified as QRIP. While ECOs - 15 and 28 are classified as No Cost/Low Cost projects.

During a meeting[3] on May 17, 1989 with the User, the following was decided:

1. When ECO - 41c would be implemented, there would be no need for ECOs - 41a and 41b. Because ECO - 41c New Washers and Dryers (Continuous Batch Process) has a higher SIR value and a lower simple amortization period than those of ECO - 41a New Washers

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* Simple Payback

** Amortization Period

Symbols "=", ">", "≥" and "<" indicate equal to, more than, equal or more than, and less than, respectively.

3 See Meeting Minutes on May 17 in Appendix B, Volume 2.

TABLE I-5

SUMMARY OF STUDIED ENERGY CONSERVATION OPPORTUNITIES (ECOs)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs)	Estimated Annual Savings (Energy) Electricity (Kwhrs)	Fuel Oil (Gals)	Energy (MBtu)	Cost Savings($)	Estimated Annual Non-Energy Savings ($)	Total Investment ($)	Disposition
1a.	Wall Insulation	1.5	15	431	3,627	504.5	2,390	0	32,790	Not recommended
1b.	Office Roof Insulation	0.60	32	606	128	19.8	125	0	4,053	Not recommended
1c.	Prod. & Rec. Roof Insulation	1.9	12	---	3,255	451.5	2,120	0	44,350	Not recommended
1d.	Pipe Insulation	---	--	---	---	---	---	---	---	Discarded
1e.	Pipe Insulation	---	--	---	---	---	---	---	---	Discarded
2.	Insulated Glass	0.05	361	106	42	6.5	41	0	14,820	Not recommended
3.	Weather Stripping	---	--	---	---	---	---	---	---	Discarded
4.	Insulated Panels	---	--	---	---	---	---	---	---	Discarded
5.	Solar Films	0.55	29	390	20	4.1	40	0	1,160	Not recommended
6.	Vestibules	---	--	---	---	---	---	---	---	Discarded
7.	Reduction of Class Area	---	--	---	---	---	---	---	---	Discarded
8.	Use of Air Curtains	1.35	--	740	1,607	195	945	(-)600	11,365	Not recommended
9.	Provide Loading Dock Enclosure	3.1	8.4	---	1,607	223	1,045	(-)4000	7,410	Discarded
10.	Booster Heaters at Major Hot Water Users	---	--	---	---	---	---	---	---	Discarded

TABLE I-5
SUMMARY OF STUDIED ENERGY CONSERVATION OPPORTUNITIES (ECOs)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs)	Estimated Annual Savings (Energy) Electricity (Kwhrs)	Fuel Oil (Gals)	Energy (MBtu)	Cost Savings($)	Estimated Annual Non-Energy Savings ($)	Total Investment ($)	Disposition
11.	Lower DHW Temperature	---	--	---	---	---	---	---	---	Discarded
12.	Use of Heat Pump for DHW Pre-Heat & Facility Cooling	---	--	---	---	---	---	---	---	Discarded
13.	Shut Down DHW Circulating Pump	0.59	21	537	---	1.8	37	0	784	Not recommended
14.	Shut Down DHW & PHW Circulating Pumps	1.03	12	1,074	---	3.7	75	0	905	Discarded
15.	Shut Down Energy to Hot Water Heaters	---	--	---	259	36.4	170	0	0	Discarded
16a.	Recover Heat from AHU-1 for DHW Pre-heat	0.11	--	(-)103	119	16.2	(-)130	(-)200	7,900	Not recommended
16b.	Recover Heat from AHU-2 for PHW Pre-heat	0.42	--	(-)103	545	74.7	(-) 3	(-)350	7,805	Not recommended
17.	Make HVAC Operations more Efficient	---	--	---	---	---	---	---	---	Discarded
18.	Thermal Storage	---	--	---	---	---	---	---	---	Discarded

TABLE I-5
SUMMARY OF STUDIED ENERGY CONSERVATION OPPORTUNITIES (ECOs)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs)	Estimated Annual Savings (Energy) Electricity (Kwlhrs)	Fuel Oil (Gals)	Energy (MBtu)	Cost Savings($)	Estimated Annual Non-Energy Savings($)	Total Investment ($)	Disposition
19.	Night Setback Thermostat	---	--	---	---	---	---	---	---	Discarded
20.	Infrared Heaters	---	--	---	---	---	---	---	---	Discarded
21.	Economizer Cycles	---	--	---	---	---	---	---	---	Discarded
22.	Upgrade HVAC Controls	---	--	---	---	---	---	---	---	Discarded
23.	Balance HVAC Sys.	9.44	1.6	7,584	6,536	932	4,775	0	7,405	Discarded
24.	Change to VAV System	---	--	---	---	---	---	---	---	Discarded
25.	Heat Destratification	---	--	---	---	---	---	---	---	Discarded
26.	Steam Traps	---	--	---	---	---	---	---	---	Discarded
27.	Verify Efficiency of Supply Steam & Condensate	---	--	---	---	---	---	---	---	Discarded
28.	Shutoff Steam Supply during Non-Use Hours	---	--	---	9,524	1,321	6,200	0	0	Discarded
29.	Correct Sizes of Condensate Lines	---	--	---	---	---	---	---	---	Discarded
30.	Insulate Boiler & Boiler Piping	---	--	---	---	---	---	---	---	Discarded

TABLE I-5
SUMMARY OF STUDIED ENERGY CONSERVATION OPPORTUNITIES (ECOs)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs)	Estimated Annual Savings (Energy) Electricity (Kwhrs)	Fuel Oil (Gals)	Energy (MBtu)	Cost Savings($)	Estimated Annual Non-Energy Savings($)	Total Investment ($)	Disposition
31.	Check Boiler Water Chemistry Program	---	--	---	---	---	---	---	---	Discarded
32.	Clean Boiler Tubes	---	--	---	---	---	---	---	---	Discarded
33.	Recover Heat from Flue Gases	---	--	---	---	---	---	---	---	Discarded
34.	Energy Conserving Fluorescent Lamps	1.48	7.5	4,180	(-) 50	7.4	257	0	1,920	Discarded
35.	Reduce Lighting Level	---	--	---	---	---	---	---	---	Discarded
36.	Replace Incandescent Lighting	---	--	---	---	---	---	---	---	Discarded
37.	Use more Efficient Lighting Source	0.37	20.5	55,250	(-)1,036	45	3,142	(-)1,181	40,230	Not Recommended
38.	Fluorescent Light Fixture Reflectors	3.74	3.1	28,138	(-)196	68.8	1,815	1,360	5,815	Discarded
39.	Heat Reclaim from Laundry Equipment	0.02	--	5,488	4,670	629.3	2,660	(-)5000	6,625	Not recommended
40.	Heat Recovery from Wash Water	---	--	---	---	---	---	---	---	Discarded
41a.	New Washers Conventional	1.45	5.8	11,690	25,306	3,551	17,287	44,588	359,735	Discarded

TABLE I-5
SUMMARY OF STUDIED ENERGY CONSERVATION OPPORTUNITIES (ECOs)

ECO No.	ECO Name	SIR	Simple Amortization Period (Yrs)	Estimated Annual Savings (Energy) Electricity (Kwhrs)	Fuel Oil (Gals)	Energy (MBtu)	Cost Savings($)	Estimated Annual Non-Energy Savings($)	Total Investment ($)	Disposition
41b.	New Dryers	2.35	9.7	44,200	---	5,189	17,540	6,120	229,110	Discarded
41c.	New Washers Continuous Batch	4.2	2.5	215,945	150,865	15,662	80,820	149,140	567,390	Recommended
42.	Humidity Sensors on Dryers	9.26	2.4	11,210	12,629	1,789	8,990	(-)250	19,188	Discarded
43.	Recycling of Rinse Water	---	--	---	---	---	---	---	---	Discarded
44.	Heat Exchanger for Dryer Exhaust	3.74	5.8	(-)16,816	36,975	5,071	22,892	(-)800	128,423	Discarded
45.	Utilization of High Temperature, Oil Heated Process	---	--	---	---	---	---	---	---	Discarded
46.	Use of Cold Water for Laundering	---	--	---	---	---	---	---	---	Discarded
47a.	Waste Water Recovery (Reactivate Existing Reclaimer)	21.2	1.3	(-) 4,946	22,555	3,111	14,331	(-)4,000	13,470	Recommended
47b.	Waste Water Recovery (Install New Reclaimer)	3.23	8.6	(-) 4,946	22,555	3,111	14,331	(-)4,000	88,355	Discarded

TABLE I-6

PRIORITIZED SUMMARY OF ENERGY CONSERVATION OPPORTUNITIES (ECOs)

ECO No.	ECO Name	SIR	SAP**	Estimated Annual Savings: Electricity (MBTU)	Electricity ($)	Fuel Oil MBTU	Fuel Oil ($)	Total MBTU	Total ($)	Estimated Annual Non-Energy Savings ($)	Total Investment ($)
47a.	Waste Water Recovery (Reactivate Existing Reclaimer)	21.2	1.3	(-)16.9	(-)341	3,128	14,672	3,111	14,331	(-)4,000	13,470
23.	Balance HVAC System	9.44	1.6	25.9	523	907	4,251	933	4,775	0	7,405
42.	Humidity Sensors on Dryers	9.26	2.4	38.3	774	1,752	8,215	1,790	8,990	(-)250	19,188
41c.	New Washers - Continuous Batch	4.2	2.5	737	14,902	20,925	98,138	15,662	80,820	149,140	567,390
44.	Heat Exchanger for Dryer Exhaust	3.74	5.8	(-)57.4	1,160	5,128	24,052	5,070	22,892	(-)800	128,423
38.	Fluorescent Light Fixture Reflectors	3.74	3.1	96	1,941	(-)27.2	(-)127	69	1,815	1,360	5,815
47b.	Waste Water Recovery (Install New Reclaimer)	3.23	8.6	(-)16.9	(-)341	3,128	14,672	3,111	14,331	(-)4,000	88,355
9.	Provide Loading Dock Enclosure	3.1	8.4	--	--	223	1,045	223	1,045	(-)4,000	7,410
41b.	New Dryers	2.35	9.7	151	3,050	---	---	5,189	17,540	6,120	229,110
1c.	Production & Receiving Roof Insulation	1.9	12	--	--	451	2,117	451	2,120	0	44,350
1a.	Wall Insulation	1.5	15	1.5	30	503	2,359	505	2,390	0	32,790

TABLE I-6
PRIORITIZED SUMMARY OF ENERGY CONSERVATION OPPORTUNITIES (ECOs)

ECO No.	ECO Name	SIR	SAP**	Estimated Annual Savings						Estimated Annual Non-Energy Savings ($)	Total Investment ($)
				Electricity		Fuel Oil		Total			
				(MBTU)	($)	MBTU	($)	MBTU	($)		
34.	Energy Conserving Fluorescent Lamps	1.48	7.5	14.3	288	(-) 7	(-)33	7.4	257	0	1,920
41a.	New Washers - Conventional	1.45	5.8	40	807	3,510	16,460	3,551	17,287	44,588	359,735
14.	Shut Down DHW & PHW Circulating Pumps	1.03	12	3.7	75	---	---	3.7	75	0	905
8.	Use of Air Curtains	0.84	--	(-)14	(-)283	223	1,045	195	480	0	11,365
1b.	Office Roof Insulation	0.60	32	2.1	42	17.7	83	19.8	125	0	4,053
13.	Shut Down DHW Circulating Pump	0.59	21	1.8	37	---	---	1.8	37	0	784
5.	Solar Films	0.55	29	1.3	27	2.8	13	4.1	40	0	1,160
16b.	Recover Heat from AHU-2 for PHW Pre-heat	0.42	--	(-) 0.35	(-) 7	75	355	74.7	(-) 3	(-)350	7,805
37.	More Efficient Lighting	0.37	20.5	189	3,816	(-)144	(-)674	45	3,142	(-)1,181	40,230
16a.	Recover Heat from AHU-1 for DHW Pre-heat	0.11	--	(-) 0.35	(-) 7	16.5	77	16.2	(-)130	(-)200	7,900
2.	Insulated Glass	0.05	361	0.4	9	5.8	32	6.5	41	0	14,820
39.	Heat Reclaim from Laundry Equipment	0.02	--	18.7	379	611	2,281	629.3	2,660	(-)5,000	66,625

TABLE I-7 - ECO'S CLASSIFICATION

					SAVINGS MBTU	
A.	ECIP	SIR	SAP	INVESTMENT, $		SAVING, $
	41c - New Washers & Dryers (Continuous)	4.2	2.5	567,390	15,662	80,820
	41b - New Dryers	2.35	9.7	229,110		17,540
	41a - New Washers (Conventional)	1.45	5.8	359,735		12,287
B.	ORIP					
	47a - Waste Water Recovery	21.2	1.3	13,470	3,111	14,331
	23 - Balance HVAC System	9.44	1.6	7,405	933	4,775
C.	No Cost/Low Cost					
	15 - Shutdown Energy to H.W. Heater	---	---	0	36	170
	28 - Shutoff Steam Supply	---	---	0	1,321	6,200
					21,063	106,296

NOT PROGRAMMED

SIR - Saving Investment Ratio

SAP - Simple Amortization Period

and ECO - 41b New Dryers, ECO - 41c was recommended and ECOs 41a and 41b were discarded.

2. Because ECO - 47a was classified as a QRIP, the Waste Water Heat Recovery ECO utilizing the existing recovery system would be implemented by the Operation Division as soon as possible.

3. ECO - 23, which would require a reduction in make-up air to the Receiving Area to 2 cfm per square foot,[4] was discarded because the existing HVAC system was inoperative during the investigation period of the Laundry Facility, and hence, the adequacy of the system was not determined. Therefore, a reduction in make-up air might result in an inadequacy of the ventilation air in the area.

4. ECOs - 15 and 28 requiring shut-off steam supply to H.W. heaters and laundry equipment were discarded because it might not be convenient for the operator and most probably would not be done; and hence, energy savings would not be realized.

5. No other ECO was of interest to the User.

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4 Based on ASHRAE general ventilation requirement.